Organizational Barriers to Innovation as they Relate to a Proposed Fire Inspection Alternative

EXECUTIVE PLANNING

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ABSTRACT

The Prince William County (Virginia) Department of Fire and Rescue (Fire Department) maintained Virginia Statewide Fire Prevention Code (Code) compliance through inspections performed by in-service fire tactical units. When the program was initiated 25 years ago, fire tactical units had adequate slack time to perform fire inspections. The strategy of using in-service fire tactical units leveraged the ability of the Fire Department to achieve Code compliance.

As the number of services provided by the Fire Department along with a corresponding increase in demand volume continued to escalate, the sustainability of the inspection program became increasingly difficult. The problem the Fire Department had was that its fire inspection program no longer had adequate resources available in the form of in-service tactical units to perform the inspection duties that were required. A proposal with supporting justification was submitted to the Fire Department in 1996 to test the concept of self-inspection fire prevention that allows building operators to perform their own fire inspection, correct deviations they discovered, and certify to the Fire Department that their property is in compliance with the Code. That proposal was not acted upon by the Fire Department. The purpose of this research was to determine the cause of organizational barriers to innovative proposals such as the self-inspection fire prevention concept and to evaluate the existing fire prevention inspection model.

This research employed evaluative research methods. The research questions were:

1. Can the Fire Department structure its fire prevention organization around business processes that reflect a customer viewpoint rather than the influence of traditional departmental structures?
2. Can the effectiveness of the fire inspection program be measured?
3. Would a self-inspection program be a viable alternative approach to the Fire Department's fire prevention effort?

A time series analysis covering a period from 1979 to 1997 was performed to determine the compliance rate of inspected properties compared against two fire stations that served as a control group. The level of Code compliance of the sample population generally exceeded the level of Code compliance for the fire stations.

The research found that barriers to innovative changes are more likely to be overcome in organizations that experience crisis such as budget famine and dramatic performance failures or that experience budget surges and also have a leader who is committed to change. The fire inspection program has had stable performance output under stable fiscal conditions. No conditions existed to make a compelling justification to initiate change to a program that, from an internal organizational perspective, was working. As a result, the inertia needed to overcome the barriers to change will require the Fire Department leadership to establish a practice of organizational learning that causes them to question the appropriateness of established programs through environmental scanning and proper evaluative actions. The Fire Department must then be willing to take risk to depart from those established programs to respond with appropriate actions when environmental conditions that would support change are discovered. The research found that precedents have been set in the fire service profession for successful self-inspection

programs and that it would be feasible to maintain the Code compliance through self-inspection in Prince William County. The research further recommended that the Fire Department become fully skilled in the art of organizational learning and to begin experimentation with the self-inspection fire prevention concept.

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INTRODUCTION

The Prince William County (Virginia) Fire and Rescue Department (Fire Department) performs a fire inspection program that makes use of in-service fire and rescue tactical units to conduct the inspections. The purpose of the fire inspection program was to assure the compliance of the Virginia Statewide Fire Prevention Code (Code) through periodic inspection of all occupancies in Prince William County subject to enforcement under the provisions of the Code. The use of in-service tactical units to conduct the inspections was intended to take advantage of slack resources which had been defined as the time that tactical units were not performing emergency service duties.

The problem the Fire Department had was that it no longer had adequate resources available in the form of in-service tactical units to perform the inspection duties that were required to sustain a program that was designed and implemented in 1972. The fire inspection program has never been thoroughly evaluated to determine if it has accomplishing expected goals or if it could be improved upon in any way. No resources have ever been formally appropriated to the fire inspection program. However, since the fire inspection program's inception other duties and responsibilities have accumulated for the tactical units that were performing fire inspections and the demand for emergency service had increased to a level that far exceeded the supply of personnel and other resources to meet that demand. In 1996, the author performed an analysis of the willingness of the building operators had to perform self-inspections by conducting fire inspections of their properties, take corrective action when a discrepancy was found, and certify to the Fire Department that they were in compliance with the Code. That study was performed to determine if a self-inspection program, as an alternative fire prevention

model, could be implemented in a way that improves building operator (customer) satisfaction and improve efficiency of the Fire Department. The purpose of this research is to determine the cause of organizational barriers to adoption of innovative proposals, such as the self-inspection fire prevention program, and to evaluate the existing fire inspection model.

An evaluative research methodology was used as the research model. Research information was obtained at the George Mason University Library and the Learning Resource Center of the National Emergency Training Center. The research questions to be answered were:

1. Can the Fire Department structure its fire prevention organization around business processes that reflect a customer viewpoint rather than the influence of traditional departmental structures?
2. Can the effectiveness of the fire inspection program be measured?
3. Would a self-inspection program be a viable alternative approach to the Fire Department's fire prevention effort?

The evaluation of the fire prevention and enforcement model was targeted for study through research methods specified by the National Fire Academy Executive Fire Officer Program as an applied fire service delivery problem.

BACKGROUND AND SIGNIFICANCE

Fire was identified as a major problem in the United States during the 1970s as the estimated cause of death for 6,200 persons annually. In addition, over 100,000 persons were injured by fire each year. Fire also resulted in $10.4 billion in property damage annually. To compound the problem, the general public was generally indifferent toward the issue of fire prevention and control. The United States led all the major industrialized nations in per capita deaths and property loss from fire (NCFPC, 1973, p. 2). The indifference toward fire prevention and control was also identified by fire officials in Prince William County. As a result, in 1972 the Fire Department designed and implemented a fire inspection program targeted for all inspectable properties. The influence of the publication of America Burning coupled with the recognizable fire control problem in Prince William County spurred the Fire Department to select the most aggressive strategy alternative it had identified to maintain Code compliance. That strategy focused on fire prevention inspections that were conducted by in-service fire tactical units.

The use of in-service fire tactical units leveraged the capabilities of the Fire Marshall's Office to manage fire prevention and control. The Operations Division, which is responsible for emergency response, had the bulk of the Fire Department's personnel resources. The use of in-service units was the only feasible means of scheduling annual or semiannual fire prevention inspections for every inspectible property in Prince William County. The Fire Marshall's Office became relegated to conducting only follow up inspections to properties that were identified by the in-service tactical unit during a fire inspection as having life safety risks and to performing spot check inspections that were targeted at enforcing occupancy load violations.

This model of fire prevention inspections has not changed since its inception in 1972 with the exception of marginal changes in inspection frequency. The inspection frequency rate was changed in 1988 from two inspections per year for all occupancies to one inspection.

The Operations Division had evolved from 1972 to a point where a much wider array of services are being provided with a significantly larger volume of emergency service work load when compared to the work activities and volume of 1972. The changing service demand has placed enormous pressure on the Operations Division to conduct a relatively time intensive inspection service with a continuously growing work load for emergency services.

The Fire Department had a steady growth rate during the 1970s that was consistent with population growth. During the 1980s, the population growth surged from 144,703 in 1980 to 215,686 in 1990 along with a comparable commercial growth rate (Prince William County Information, 1997, p.4) (see Appendix C). Although the growth rate of the Fire Department did not keep pace with the population and commercial growth rates in Prince William County, there were continuos budget improvements provided to the Fire Department each fiscal year during this 10 year period. In 1991 the Fire Department experienced a marginal organizational down sizing in reaction to an unexpected fiscal downturn for the Prince William County Government that was repeated two additional consecutive years. Beginning in fiscal year 1994, the Fire Department began to once again experience continued organizational growth. (Prince William County Office of Executive Management, 1997, pp. 264-265, 268).

The population and commercial growth rates in Prince William County continued during this period, but at a lower pace than was experienced in the 1980s. The average annual growth rate since 1980 was 3.5% and forecasted to continue at a 3.6% annual growth rate through 2020. The current population of 262,921 is expected to grow to 428,000 by 2020 which represents a doubling of the 1990 population (Prince William County Information, 1997, pp. 3-4). Employment growth, which is an indicator of economic growth, is forecasted to have a 3.7% annual growth rate through 2020. (Prince William County Information, 1997, p.4) (See Appendix B.)

Emergency fire and rescue service demand has outpaced both the population and employment growth rates from 1990 to 1997. The Fire Department had an increase of emergency incidents from 13,196 in 1980 to 17,293 in 1990. The Fire Department responded to 22,505 incidents in 1996. The average annual incident growth rate from 1980 to 1996 has been 4.4%. (See Appendix D)

In 1996, the author conducted an applied research study to evaluate the self-inspection concept designed to allow trained and authorized property operators to certify to the Fire Department that their property was in compliance with the Code. The results of the study concluded that a large enough portion of the operators of inspectible properties would support and comply with the provisions of a self-inspection program and recommended that the self-inspection concept be implemented as a demonstration project to obtain a more definitive evaluation (McGee, 1996, pp.19, 38). However, the Fire Department took no action to consider such a recommendation despite numerous attempts to present the proposal.

The topic of this research relates to the analysis module of the Executive Planning course by exploring a process redesign proposal that did not fully consider processes, activities, and procedures within the department that would be a barrier to adoption of an alternative fire service delivery program.

LITERATURE REVIEW

Government agencies, such as the Fire Department, exist fundamentally to serve the public interest, and for the most part do so expertly. However, government centered ineffectiveness that have been uncovered such as the Three Mile Island crisis and the Challenger Space Shuttle explosion have resulted in serious doubts about the capacity of government organizations to solve problems they are faced with correcting (Kemeny, 1980, p. 70). The U.S. General Accounting Office concluded, "The state of management in government is not good. Too many principles, structures, and processes that may have worked well years ago no longer allow government to respond quickly and effectively to a rapidly changing world" (Kenemy, 1980, p.74). The foundations of government bureaucracy that were developed through the last century are not up to the challenges of the next, and therefore, do not fit new problems. Consideration of public service failures and the analysis of their underlying causes are important in influencing the research project to identify signs of program weaknesses before a point of catastrophic failure is reached. Public organizations at all levels of government are finding that any attack on problems [such as fire prevention and control] will require an integrated assault that involves multiple agencies, federal-state-local partnerships and public-private alliances (Kettl, 1994, p.21).

For the Fire Department to surmount these challenges, it must discover how to learn more effectively. It must discover how to design new methods to solve problems more quickly and cheaply. Organizational learning occurs when the individuals working in an organization observe the effects of their actions, when they recognize the problems that remain unsolved and the new problems that may be created, and when they adapt and change to solve these new problems (Foil and Lyles, 1985 p. 803; Hedberg, 1981, p.3).

Therefore, organizations learn when their members improve their understanding, on the basis of observed results, about what works, what does not, and why (Kettl, 1994, p. 21).

If learning is to occur, it must happen when and where “organizations interact with their environments” (Hedberg, 1981, p.3). That logically, is where organizations are most likely to detect what effects they are producing, what otherwise is happening that may affect them, and how it all matters. Therefore, organizational boundaries are primary points of organizational learning.

Learning requires effective communication since learning is a process that stems from information. Bias, distortion, and condensation of information within organizations can make it hard to detect and read signals accurately. Communications across organizational boundaries are often more difficult which creates a dilemma for organizational learning. Tushman (1984) has noted that, “accurate information from external areas is vital to the innovation process yet relatively difficult to gather” (p. 587).

Organizational boundaries are the critical sites for learning. Since learning is dependent on managing information, it hinges on organizations’ ability to develop individuals who can operate effectively to span those boundaries (Tushman, 1984, p. 590). Effective learning, and hence, effective Fire Department management requires organizations to look past their internal operations, to gauge what is happening in the boarder environment, to estimate the implications of these events for the Fire Department’s mission, and to adapt to those new challenges (Kettl, 1994, p.22). It also requires that the recognition that the more complex and uncertain the environment is, the more difficult the task of learning will be and the more important it becomes. It requires the aggressive development of new ways of training Fire Department officers to solve the

rapidly evolving problems that surface. Environments are “changing, at an increasing rate, and towards increasing complexity” (Emery and Twist, 1985, p.21).

Fire departments are discovering they must learn in order to survive. To learn, they must adapt their learning systems to fit the varying uncertainties and complexities in their environments. Kettl (1994) has identified four factors that complicate learning that include; 1) the bureaucracy’s assumed monopoly on information has declined and therefore cannot presume that it knows what it needs to know, 2) its dependence on outside sources of information has increased resulting in a more complex process of learning, 3) citizens’ confidence in knowledge of all kinds has declined resulting in increased difficulty in developing confidence in the learning process, and 4) sources of knowledge are becoming increasingly decentralized, and conflicting interpretations complete to define what we know (pp. 22-23).

Organizational theory claims that for a bureaucracy to learn, it has to perceive what is happening in the environment, know how to make sense of these perceptions, and then know what to do in response. In effect, a learning fire department must be an open bureaucracy, permeable at its boundaries. It is therefore, essential that its members can be trained to be smart enough to make sense of the overwhelming flood of signals the environment generates (Kettl, 1994, p.32). If fire departments are to be more effective, they must learn better. If they are to learn better, they must develop better ways of collecting, processing, and interpreting information. According to Senge (1990), if an organization is to learn, a culture must permeate the organization; “Team learning is vital because teams, not individuals, are the fundamental learning unit in modern organizations”

(p.10). Effective learning rests on a sense of the organization as an indivisible whole (Kettl, 1994, p. 36).

Uncertainty is a critical factor to which organizations are continuously exposed. Organizations often respond by seeking to avoid uncertainty. Public organizations are typically dynamic institutions that change adaptively as the result of experience. Over time organizational learning produces changes in goals, standard operating procedures, and alternative search procedures. (Allison, 1971, p. 77) Organizational learning and change follow, to a large degree, from existing procedures, although marked changes in organizations do occasionally happen. The conditions in which substantial changes are more probable include; 1) conditions where the organization is experiencing budgetary feasts with a leader who is committed to change, 2) prolonged budgetary famine that causes loss of effectiveness, and 3) dramatic performance failures that causes demand for change from outside the organization, existing personnel are less resistant to change, and key members of the organization are replaced by individuals committed to change (Allison, 1971, p. 85).

Allison (1971) noted that once a program is undertaken it is not dropped at the point where objective costs outweigh benefits (p. 91). Organizational momentum carries the program well beyond the loss point (Allison, 1971, p.91). Further, there must be administrative feasibility for change. That is, there must be adequate explanation, analysis, and prediction of proposed changes that includes administrative feasibility as a major dimension. Projects that demand that organizational units depart from their established programs to perform unprogrammed tasks are rarely accomplished in their designed form. Projects that require coordination of the programs of several organizations are also rarely

accomplished in their designed form. Existing organizational goals and routines are not impervious to directed change. Careful targeting of major factors that support routines such as personnel, rewards, information, and budgets can effect changes over time. (Allison, 1971, pp. 93-95)

Cybernetics is a relatively new interdisciplinary science focusing on the study of information, communications, and control. The term has a metaphorical application of the Greek *kubernetes*, meaning “steersman” (Morgan, 1997, p.83). The Greeks developed the concept of steersmanship most likely from their understanding of the processes involved in the control and navigation of the watercraft, and extended its use to the process of government and statecraft.

According to Morgan (1997), cybernetics thus leads to a theory of communication and learning that stresses the following principles;

1. Systems (i.e. organizations) must have the capacity to sense, monitor, and scan significant aspects of their environment;
2. Systems must be able to relate this information to the operating norms that guide system behavior;
3. Systems must be able to detect significant deviations from these norms, and;
4. Systems must be able to initiate corrective action when discrepancies are detected (pp. 84-85).

When these four conditions are satisfied, a continuos process of information exchange is created between a system and its environment, allowing the system to monitor changes and initiate appropriate responses. However, the learning abilities that these principles define are limited in that the system can maintain only the course of action

determined by the operating norms or standards guiding it. As a result of this condition, cyberneticians have drawn a distinction between the process of learning and the process of learning to learn. (Morgan, 1997, p.86)

The process that results from the four principles identified above has been referred to as a single-loop learning model. A house thermostat serves as an analogy of the single-loop process in regulating the temperature of a house. The thermostat however, is unable to determine if the temperature it is regulating is appropriate to meet the preferences of the inhabitants. More useful cybernetic models include a double-loop to identify a process of questioning whether operating norms are appropriate. It is this kind of self-questioning ability that underpins the activities of systems that are able to learn to learn and self organize. (Senge, 1990, pp.72-74)

Employees are usually encouraged to occupy and keep a predefined place within the whole, and are rewarded for doing so. Situations in which policies and operating procedures are challenged tend to be the exception rather than the rule (Morgan, 1997, pp.88-89). These single loop learning system conditions reinforce themselves and may actually serve to keep a department on the wrong course.

The fire service literature includes examples of fire departments that have implemented self-inspection programs. The study of programs in place in other jurisdictions, such as the self-inspection concept, provides a useful framework to examine the potential feasibility and an anticipation of program consequences when applied in Prince William County.

Gwinnett County, Georgia initiated a self-inspection program in response to public pressure to reduce the involvement of government in business and personal activities. The

Gwinnett County Fire Department designed a carefully structured program that was a result of a joint effort between the insurance industry, business operators, and the Fire Department. The business operators were responsible to perform their inspection, correct any deficiency observed, and notify the Fire Department through a mail-in card that their property was in compliance with the Fire Prevention Code. Reminder notices for past due inspections assisted in achieving a 97% return rate for inspection forms. A random spot-inspection procedure was developed to determine quality control of self-inspections. The Gwinnett County Fire Department has determined that discrepancies between self-inspections and spot-inspections by the Fire Department were low enough for them to conclude the self-inspection program was a reliable way to maintain code compliance. (Self-fire, 1980, pp. 34-35)

The Arvada Fire Protection District (Colorado) reported high quality results through the use of the self-inspection model that was designed to target only business occupancies (B-2 occupancy type). The secondary benefits that were realized from their program included improved Fire Department productivity along with an increased ability for them to focus their staff resources on the highest risk occupancies. The Arvada Fire Protection District targeted B-2 occupancies because this group had lower rates of fire code violation compared to other occupancy types. The Arvada self-inspection program also improved the image that business people had for the Fire Department. (Delay, 1991, p.10)

The Foothill Fire District (Georgia) instituted a self-inspection program that resulted in a higher fire safety consciousness of the business community. The program had a building owner education component that contributed to continuity of Fire Prevention Code compliance to a higher level than could be achieved from a fire department based

inspection program (Vera, 1983, pp.11-12). The Foothill Fire District experience reinforces the conclusion of the National Commission on Fire Prevention and Control (1973) that failures to recognize hazards and take appropriate prevention actions “cannot be legislated out of existence; they must be dealt with through education” (p. 105).

Merchant (1991) reported varying levels of code compliance from self-inspection programs for five jurisdictions he surveyed. The results of Merchant’s research included Mesa, Arizona with a 37% compliance rate, Chandler, Arizona and Salt Lake City, Utah with compliance rates ranging from 50% to 70% and finally, Rancho Cucamonga, California, and Colorado Springs, Colorado each with a 98% compliance rate (p. 5). After conducting follow-up personal contact with each of the jurisdictions included in this survey it was determined that there was no standard definition of code compliance. The inconsistency of the code compliance definition for each of these jurisdictions resulted in a wider variation in code compliance rates than would otherwise be expected which places into question the validity of the survey methodology. However, based on the Merchant survey and follow-up communications by the author there was no evidence to indicate that the self-inspection programs would be deemed unsuccessful by the respective jurisdictions and that code compliance can remain at least consistent with Fire Department based inspection programs.

PROCEDURES

A longitudinal study was conducted using a time series analysis to evaluate the effectiveness of the fire inspection program. Data was collected for the analysis through a nonproportionate stratified random sampling procedure. Four inspectable occupancies were randomly selected from each of the 16 fire and rescue first due areas. The total sample size was 64. Selection from each first due area assured that all areas in the County were adequately represented in the sample since they would all be included in a self-inspection program. An alphabetically sorted list of inspected occupancies was produced with the occupancies for each first due area (see Appendix A).

A random number (20) was selected using a random numbers table. The twentieth, twenty first, and twenty second occupancies of each first due inspections list was used to select the occupancies for study. A skip interval between selected inspections was not necessary since there were no associations between occupancies on the list other that they were in alphabetical order. A check was conducted to determine if any of the sample set occupancies had the same owner or occupant. For any sample that did have the same owner or occupant the sample selected first would be retained for study and the subsequent samples would be rejected and the next occupancy on the list would be selected.

A randomly selected sample would be rejected and the next occupancy on the list would be selected as a replacement if the occupancy did not have inspection records spanning the sample frame or if the occupancy was an apartment building.

The target population included all occupancies whose entire property was subject to inspection built prior to 1979 and included records of inspection in the Fire Marshal's

Office archive for the sampling frame. Occupancies were included in the study if they had missing inspection records because of the difficulty in finding complete sets if records spanning the sampling frame. The average violation rates were calculated discounting any missing inspection record. The study did not include evaluation of apartment occupancies because the largest proportion of these buildings are residential and, therefore, not subject to inspection. Only the apartment building common areas that are not part of the residential units are subject to inspection. Consideration of apartment buildings in the study would not be a reliable measure because an accurate compilation of fire prevention code violations cannot be obtained. An example of one such measurement would have been the documentation of missing or inoperable smoke have alarms in rented residential units. Inclusion of apartment buildings in the study had potential to skew the data results to show less than an accurate number of code violations.

The sampling frame covered a period from 1979 to 1997 and data was collected for the times series analysis using odd year records to yield an 18 year analysis with 10 odd year data points. The inadequate maintenance of records prior to 1979 made the collection of an appropriate sample of inspection data prior to 1979 unfeasible.

A comparative analysis was conducted using two occupancies that had building operators who were knowledgeable of the code and fire safety practices. The purpose of the comparison was to measure the gap between the volume of fire prevention code violations for occupancies that had operators who were knowledgeable of the Code to operators in occupancies who were unlikely to be knowledgeable of the Code. All fire and rescue stations have operators who are proficient in their knowledgeable of the Code. Two randomly selected fire and rescue stations were selected using a random number

table. Six and fifteen were the random numbers selected which corresponded to Coles District Volunteer Fire Department Station 6 and Evergreen Volunteer Fire Department station15. These two fire and rescue stations were used for the comparative analysis. Both of these facilities are Prince William County fire stations.

The inspection forms were modified several times during the research period. A fire prevention code rating form was created to consolidate all three forms that were used during the various periods of the research time frame. An interrater evaluation was conducted to assure the accuracy of the research study form. A 100% interrater agreement rate was achieved. See Appendix A for current inspection form and code form conversion table for original inspection form. The data was compiled in a software data base program to minimize the potential of mathematical and data cross tabulation error.

The frequency of inspection was reduced in 1988 for business occupancies from twice per year to once per year. This change is the only substantive change made to the fire inspection program since its inception. The first inspection was used for the research study for any occupancy that had multiple inspections done during the calendar year.

Limitations

Fire prevention activities such as fire inspection programs have easily measured outputs but have outcomes that are difficult to measure. The numbers of inspections or the numbers of violations cited are examples of outputs that can be measured. However, the number of fires prevented, fire injuries prevented, or fire fatalities prevented are examples of outcomes that are not measurable but are the precisely the aspects of the program that need to be determined to properly evaluate fire inspection success. Morgan (1997) refers

to programs that have measurable outputs without measurable outcomes as procedural programs (pp. 163-167).

Morgan (1997) has concluded that determination of the success of procedural programs result in means oriented evaluation (p. 164). Since outcomes cannot be feasibly measured for this study the output will be evaluated as the next best way to determine the impact of the fire inspection activity on program success.

Inspectable occupancies constructed after 1979 are not included in this study because they cannot offer the time series data that are necessary to conform to the research methodology. There is a possibility that these buildings have characteristics or features that could result in either more or less fire prevention code violations than would be observed from older buildings. If such a condition exists, the reliability of the data would weaken for each progressive time interval in the research time series.

The sample set was limited due to the extensive data collection effort that was needed to compile inspection records for the occupancies selected for study. The limitation of research time was the key factor for limiting the sample set. A smaller size sample set increases the risk that the researcher will not be able to accurately apply the results to the population.

The fire inspection report archive contains paper files. The files did not have a complete set of inspection records leading to missing data in the research data base. Missing data was discounted from any calculation performed for the research study.

The fire service literature provides examples of self-inspection programs along with documentation of the programs' results. This applied research study was unable to determine all the variables in each case in order to conclusively validate the external

suitability of conditions in the jurisdictions where documentation exists to conditions in Prince William County. The lack of literature documenting problems or failures with the self-inspection program may be an indicator that a tendency exists in the fire service profession to document successful programs rather than those that are unsuccessful. If such a tendency exists, the professional literature archive documenting the self-inspection topic may be historically biased.

Definitions

Building operators: the building owner, business manager, or institution administrator whose property is subject to Fire Department inspection to assure compliance with the Virginia Statewide Fire Prevention Code.

First due area: the primary emergency response area for each fire and rescue station. All inspectable properties within this area are inspected by the fire units assigned to their respective station.

Learning organization: a process where individuals working in an organization observe the effects of their actions, recognize the problems that remain unsolved and the new problems that may be created, and adapt and change to solve those problems (Foil and Lyles, 1985; Hedberg, 1981; Rainey, 1985)

Self-inspection: A procedure performed by the property owner to inspect all structures and premises for the purposes of ascertaining and causing to be corrected any conditions liable to cause fire, contributing to the spread of fire, interfere with fire fighting operations, endanger life or any violations of the provisions or intent of the fire prevention code and any other ordinance affecting fire safety.

RESULTS

The research provides a basis to conclude that barriers to implementing innovative programs that reflect a customer viewpoint can be overcome. The self-inspection program is one example of an innovative practice that would constitute a significant departure from the traditional Fire Department approach to fire prevention. The results of this research are presented to respond to the three research questions.

1. Can the Fire Department structure its fire prevention organization around business processes that reflect a customer viewpoint rather than the influence of traditional departmental structures?

The fire Department can structure its fire prevention resources around business processes that reflect a customer viewpoint if it can incorporate cybernetic principles into its strategies for fire prevention and control. Such a process invites the Fire Department to examine the status quo and consider alternative modes of operation. The shift to a double-loop learning process would encourage the Fire Department to understand key fire prevention attributes from the standpoint of a new frame of reference. If the Fire Department can make this fundamental shift it would position itself to detect the point when program objective costs begin to outweigh benefits as well as to consider the perspective of the customer when designing and evaluating program changes.

The use of the double-loop learning model will provide a mechanism for the Fire Department to learn how to learn. This is what it takes to reinvent existing modes of operation such as Code enforcement. Changes to well established, traditional programs similar to the in-service fire inspection program will not be expected to come under proper scrutiny for change unless either the program falls into a crisis, or the Fire Department

learns to question whether its operating norms are appropriate. In order to initiate change though the learning process rather than as a result of crisis, the Fire Department will need to establish the capacity to sense, monitor, and scan significant aspects of the environment, be able to relate this information to the operating norms that guide both employees and building operator behavior, and be able to detect deviations from the norm or opportunities for improvement.

2. Can the effectiveness of the fire inspection program be measured?

The effectiveness of the fire inspection program using in-service tactical units was evaluated using a time series analysis of its primary output. The primary output of the fire inspection program are the violations of the code, documented on the inspection report. Evaluating program effectiveness for prevention programs using outcome measurements would be preferable, however there is no valid means to measure fires, fire injuries, fire fatalities prevented that can be directly related to the fire inspection program.

Figure 1 Average number of Code violations documented per occupancy by year

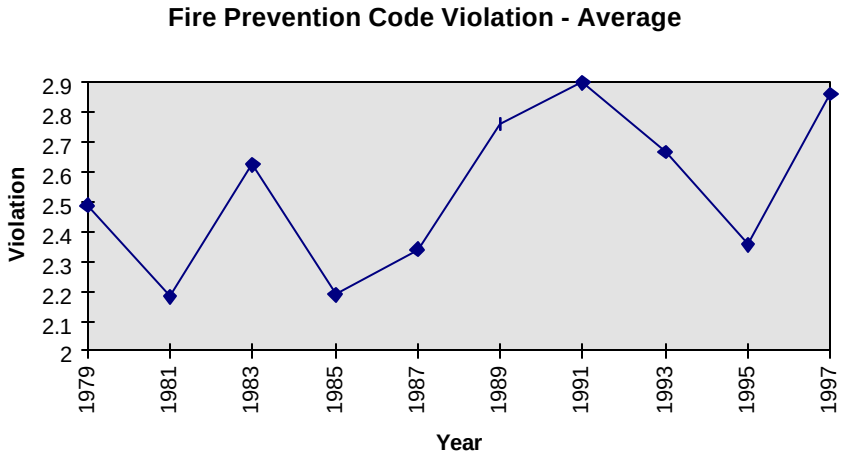


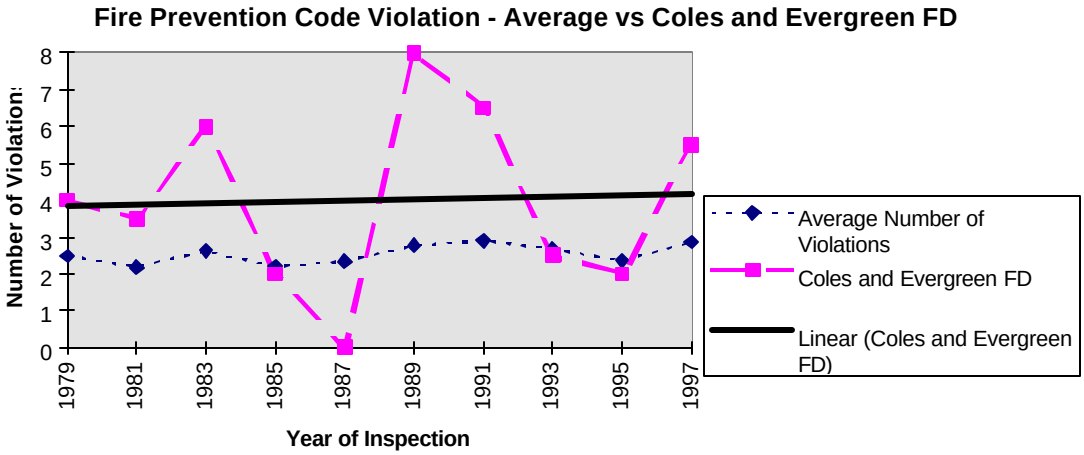
Figure 1 shows the average number of Code violations documented for the occupancies (n=64) randomly selected for this study. The average number of annual violations per occupancy falls within a relatively narrow range from 2.2 violations in 1981 to 2.9 violations in 1991. The average number of Code violations per occupancy is relatively stable over the 18 year study period. One expectation that would have been anticipated with a program designed to maintain compliance with the Code was that the average number of violations would show a pattern of improving violation rates as time progressed. The results do not show a declining average violation rate. There is one mode average of 2.9 in 1991. The trend is indicating that a second mode average is emerging at the end of the study time frame (1997).

The reduction of the frequency of inspections in 1989 resulted in a corresponding increase in average Code violations that peaked in 1991 and declined in subsequent years. This is an indication that the increase in violations resulting from a lower inspection frequency had only a temporary adverse impact. The building operator may have depended on the Fire Department inspections to identify for them the corrections that needed to be made to comply with the Code. An interpretive explanation to the subsequent decline is that building operators developed an awareness of increasing Code violations and that the inspections were becoming less frequent, and therefore, became more self sufficient in maintaining their property. This explanation is consistent with a 1996 survey (see Appendix E) conducted by the author to determine the feasibility of implementing a self-inspection program. The question was asked of 106 building operators if fire prevention was a component of their risk management strategy. Seventy-two percent (n=76) indicated that fire prevention was a component of their risk

management strategy and only 28% (n=30) indicated either it was not or they were unsure. Building operators are generally interested in preventing fire in their buildings and can be expected to take steps to improve conditions when they become worse.

A comparative evaluation of the sampling of average Code violations was made against two fire and rescue stations. The fire and rescue stations served as a control group in this comparison because they are staffed by Fire Department employees who have a familiarization of the Code and have expertise in conducting fire inspections resulting from the normal duties of their assignment.

Figure 2 Comparative average Code violations documented



The comparison of the average Code violation rate of the sample population to the control group is represented in Figure 2. A highly variable average rate of Code violations was found for the control group ranging from a low of no violation in 1987 to a high of 8 violations in 1989. The high variability is primarily due to the small sample size of two occupancies. Based on the central tendency theory, the trend would smooth with an increased sample size. To compensate for the high variability of Code violations for the

control group, a trend line of control group violations was inserted to facilitate the comparative interpretation. The comparison shows that the general sample population performed better in complying with the Code than did the sample group of occupancies with building operators knowledgeable of the Code for 6 of the 10 years studied. The general sample population consistently outperformed the control group trend line in maintaining their properties to compliance with the Code. This evidence is an additional indicator that building operators are interested in fire prevention in their overall risk management strategy and do maintain their properties to comply with the Code.

The evidence compiled through this research study indicate that although the outcomes of the fire inspection program cannot be measured to a satisfactory level there are significant amount of output data that are measurable. These data along with methodologies to measure them serve a useful purpose in evaluating the program success and in providing a means to identify and explain the affects that program modifications have on the ability to maintain Code compliance.

3. Would a self-inspection program be a viable alternative approach to the Fire Department's fire prevention effort?

The fire service literature provides a number of anecdotal examples of self-inspection programs that were reported to be accepted by the public and resulted in improvements to either the efficiency or effectiveness of the fire department. There are no examples in the literature of self-inspection programs where fire prevention code compliance was unable to be maintained using self-inspection methods. In a survey conducted in 1996 by the author, building operators in Prince William County were asked if they would be willing to self-inspect their property (see Appendix E). Of 106 respondents,

83% (n=88) indicated that they would be willing to conduct self-inspections and of those willing to participate, 89% (n=78) would be willing to participate in training programs in order to have the authority to self-inspect. Based on the successes identified in the fire service literature, the willingness of building operators in Prince William County to participate, and the increasing demand for Fire Department services without a corresponding increase in resources, the self-inspection program would be a viable alternative approach to the Fire Department's fire prevention effort.

The obstacle to viability of the self-inspection concept has been centered around the avoidance of the Fire Department to try a new approach. This avoidance is understandable considering the conditions Allison cites that make substantial change more probable. For example, the Fire Department has not experienced either prolonged budgetary feast or famine and there have been no dramatic performance failure within the fire prevention program. The existing in-service fire inspection program has gathered 25 years of momentum that will be challenging to overcome, particularly when proposing the replacement of a program with demonstrated certainty in maintaining Code compliance.

DISCUSSION

The practice of double-loop learning has become a well established strategic practice by the Fire Department outside of the fire prevention arena. Like most organizations, the Fire Department has recognized the importance of challenging key business paradigms, using brainstorming sessions and other forms of creative thinking to create new directions. As a result of the pathbreaking work of Edward Deming, Joseph Juran, and other leaders of the "quality movement," the philosophy of promoting continuous improvement (the Japanese concept of Kaizen) and total quality management (TQM) has done much to institutionalize the practice of challenging taken for granted norms and practices at the operational level.

The challenge will be to incorporate the fire prevention strategy into the double-loop learning model process. The strength of pressures toward single-loop learning can be significant to overcome particularly for programs such as fire prevention whose outcomes are difficult to determine. When change threatens the status quo, defensive routines often kick in, diluting or diverting the attack on established practices. Many organizations get trapped in the status quo becoming myopic, accepting their current reality as the reality. To learn and change programs, such as the in-service fire inspection program, the Fire Department must be prepared to challenge and change the basic rules of the game at both the strategic and operational levels. One of the major obstacles to creating the level of change this research project supports is the interest to maintain stability of public service functions. Change can result in errors that otherwise could have been avoided. The Fire Department will need to fully develop a comfort level with the reality that to embrace the idea that in rapidly changing conditions with high degrees of uncertainty, problems and

errors will occur. However, without change the Fire Department will likely experience continued declines in efficiency, effectiveness or both until a break point is reached that may take the form of a serious and sudden failure.

The type of management practice that injects uncertainty and risk into decision making and program performance can be highly stressful for the leadership. It will be difficult for management who normally has an expectation to feel in control to become willing to ride the type of creative chaos on which innovation prospers. Yet this is the type of internal environmental condition that double-loop learning requires. The benefit of embracing such uncertainty will be to facilitate the Fire Department to adapt to the external environment by allowing new patterns of action to emerge.

RECOMMENDATIONS

The recommendations are made based on the findings of this research paper include the following:

1. Evolve organizational designs that allow the Fire Department to become fully skilled in the art of double-loop learning, to avoid getting trapped in single-loop processes, especially those created by traditional management control systems and the defensive routines of organizational members.
2. The Fire Department management should exercise its leadership skills to the fullest extent to develop its organizational culture in ways that support change and risk taking.
3. The Fire Department should establish an information processing system to collect, retrieve, monitor, store, and transmit data relating to its fire inspection program. The information processing system should be designed to adequately evaluate the existing fire inspection program and to provide a comparative data set as was used in this research project to conduct experiments or demonstration projects intended to improve either the efficiency or effectiveness of the Fire Department's fire prevention effort.
4. The Fire Department should conduct its own unbiased evaluation of the fire inspection program that incorporates a customer perspective.
5. Further critical fire service professional research should be conducted to document the efficacy of self-inspection programs.
6. The Fire Department should conduct experiments with the self-inspection concept to determine the level of building operator willingness and ability to conduct their inspection and certify Code compliance to the Fire Department. A demonstration

project could provide an experimental basis to evaluate the administrative feasibility of the self-inspection concept.

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